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In re Patent Application of:
Yuzi ANDO et al.

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For: STEAM COOKING APPARATUS Examiner: J. M. Pelham

LETTER

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Madam:

Applicant wishes to provide partial English translations of JP-A-54-127769 and JP-A-54-123749 to the United States Patent and Trademark Office as a courtesy to the Examiner. These documents were cited by the Examiner in the Office Action dated December 31, 2008. Please note that JP publication 54-127769 was originally cited with the filing of the application on September 19, 2006 and JP publication 54-123749 was cited with the IDS filed on March 2, 2007.

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Dated: March 31, 2009

Respectfully submitted,

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English Translation of Substantially the Whole of JP-A-54-123749
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1. Title of the invention

COOKING APPARATUS

2. What is claimed is:

(1) A cooking apparatus comprising:
a first heating means by electric heat,
a second heating means by high-frequency-wave, and
a third heating means by steam,
wherein
cooking can be performed by using any one of the heating means alone, and
a cooking method in which heating means are automatically switched from the second heating means or from the third heating means to the first heating means can be previously set.

(2) The cooking apparatus according to claim 1,
wherein the first heating means comprises a switch that energizes two electrothermal heaters alternately at a predetermined time interval.

(3) The cooking apparatus according to any one of claim 1 or 2,
wherein the third heating means comprises a switch that is opened and closed at a predetermined time interval while the third heating means is in operation and a heater for steam generation connected in series with the switch.

3. Detailed description of the invention

The present invention relates to a cooking apparatus that uses a high frequency wave, steam, and electric heat so that various modes of cooking can be performed efficiently and conveniently.

Conventionally, various cooking apparatuses each using a high frequency wave, steam,

or electric heat as a heating means are available; however, no single cooking apparatus has ever been proposed that uses a high frequency wave, steam, and electric heat as a heating means.

According to the invention, a single cooking apparatus can perform cooking by any of a high-frequency wave, steam, and electric heat; in addition, so that the larger number of heating means than ever may not necessitate troublesome operation, automatic switching is possible among different cooking means to suit the intended cooking; thus a wider range of cooking and enhanced usability are sought.

The invention will now be described in detail by way of an illustrated embodiment. In Figs. 1 to 3, (1) represents a cooking apparatus body that is provided with an outer case (2) and a heating box (4), which has a heating chamber (3) formed inside it. (5) represents a turntable that is provided in a lower part inside the heating chamber (3) and that is rotated by a turntable motor (6) provided in a bottom part of the body (1). (7) represents a magnetron that supplies a high frequency wave into the heating chamber (3) via a waveguide (8). (9) represents a high frequency wave supply opening. (10) represents a lamp that illuminates the interior of the heating chamber (3) through small holes (11) in a side surface thereof. (12) represents a water tank that is removably provided inside the body (1). (13) represents a vaporization chamber that has an electrothermal heater (14) for steam generation buried in a bottom surface thereof and that communicates with the water tank (12) through pipes (15) and (16). Although not shown in detail, water is so supplied from the water tank (12) into the vaporization chamber (13) as to keep a constant water level.

(17) represents a steam supply tube. (18) and (19) represent U-shaped electrothermal heaters that are provided in an upper part and a lower part, respectively, inside the heating chamber (3) and that are each set at a heat capacity of approximately 1 kW. (20) and (21) represent exhaust holes that are provided in the ceiling surface of the heating chamber (3) and in the top surface of the outer case (2) respectively. (22) represents an exhaust duct that houses a temperature detection portion (23) of a cooking temperature adjuster (40) described later, which controls the energization of the electrothermal heaters (18) and (19).

Next, the configuration of the circuit will be described. In Fig. 2, (24) represents a power supply, (25) represents a power switch, and (26) represents a door switch that is opened and closed in response to the opening and closing of a door (unillustrated) covering the heating chamber (3) and that is switched as indicated by broken lines in the figure when the door is opened.

(27) represents an operation-time adjustable timer switch that sets the energization

time of a high-frequency-wave oscillation circuit (28) – which is a second heating means configured with the magnetron (7), a high-voltage transformer, a capacitor (both unillustrated), etc. –, and the energization of a heater (14) for steam generation – which is a third heating means –, and that has timer contacts (29) and (30).

(31) represents a motor for a fan which sends cooling air to the magnetron (7). (32) represents an electrothermal cooking timer switch, which is a first heating means provided in parallel with the timer switch (27) with respect to the power supply (24). (33) represents a cooking order selection switch that can be switched between a high frequency wave and steam precedence-side contact (c) and an electric heat precedence-side contact (d). (34) represents a timer contact of the electrothermal cooking timer switch (32) which can be switched between a normal contact (a) side and a reverse contact (b) side by deenergizing and energizing. (36) represents a timer contact of the timer switch (32). (37) represents a switch that is opened and closed at a predetermined time interval during the time set by the timer switch (32); in this embodiment, the open time is set at 20 seconds and the closed time is set at 14 seconds.

(38) represents a switching switch that is opened and closed by a coil (39) deenergized or energized by the opening and closing of the switch (37) and that is repeatedly so operated as to be held at the upper heater (18) side for 20 seconds and at the lower heater side for 14 seconds as described above.

(40) represents an electrothermal cooking temperature adjuster. (41) represents a switch. (42) represents a selection switch that selects steam heating, which is the third heating means, or high frequency wave heating, which is the second heating means. (44) represents an intermittent supply switch that is opened and closed at a predetermined time interval while the timer switch (27) is in operation. (46) represents a continuous supply switch. (45) represents a cooking start switch which, when closed, is kept in that state. (47) represents a safety switch that is provided in a place where the water tank (12) is placed and that is closed when the tank (12) is placed properly.

The operation with the above structure will now be described. First, to perform electrothermal cooking (H) with precedence over high-frequency-wave cooking (R) or steam cooking (S), the selection switch (33) is switched to the (d) contact side and the electrothermal heating time is set with the timer switch (32); the timer contact (34) is then held as indicated by a solid line in the figure. On the other hand, when the selection switch (42) is set to either side and the cooking time is set with the timer switch (27), the timer contacts (34) and (35) are closed as shown by solid lines in the figure; thus, when the door

(unillustrated) is closed and the power switch (25) and the cooking start switch (45) are closed, by the timer switch (32), the contact (37) is repeatedly opened and closed and thereby the coil (39) is deenergized and energized, so that the switching switch (38) is repeatedly switched between the heater (18) and (19) sides; thus, with the atmospheric temperature inside the heating chamber (3) kept at a temperature previously set by a user with the temperature adjuster (40), electrothermal cooking (H) is performed during the time set by the timer switch (32).

When the set time passes, the contacts (36) and (34) open, and the contact (34) is switched to the reverse contact (b) side; thus high-frequency-wave cooking (R) or steam cooking (S) is performed during the time set by the timer switch (27).

Here, if the continuous supply switch (46) is kept open, the heater (14) is intermittently energized, so that a small quantity of water in the vaporization chamber (13) is vaporized and supplied intermittently into the heating chamber (3); alternatively, if the switch (46) is closed, the steam is supplied continuously.

Next, to perform, in the reverse order to the above description, high-frequency-wave cooking (R) or steam cooking (S) with precedence as shown at (ウ) and (エ) in Fig. 3, the selection switch (33) is switched to the (c) contact side, the timer switches (27) and (32) and the temperature adjuster (40) are set, and the cooking start switch (45) is closed; then the high-frequency-wave oscillation circuit (28) or the heater (14) for steam generation selected with the selection switch (42) is connected to the power supply (24) via the timer contact (30), and thus high-frequency-wave cooking (R) or steam cooking (S) is performed. When the time set with the timer switch (27) passes, the timer contacts (29) and (30) open; thus the heaters (18) and (19) are connected to the power supply (24) via timer contacts (30) and (36) so as to perform predetermined electrothermal cooking (H).

If the switch (41) is kept open, the coil (39) remains unenergized, so that the switching switch (38) is switched to and held at the upper heater (18) side; thus it is possible to perform roasting with intensive radiant heat generated by the upper heater (18) alone.

Shown at (ア) in Fig. 4 is a case where, at switching from electrothermal cooking (H) to high-frequency-wave or steam cooking (R) or (S), both modes of cooking are performed simultaneously for a predetermined time (T); shown at (イ) in Fig. 4 is a case where cooking is performed in the reverse order to (ア). For example, one specific way to realize the method of (イ) is to provide, as shown in Fig. 5, a timer device (47) that is energized for a predetermined time (T) after the time the timer contact (30) opens.

Separate timer switches for high-frequency-wave heating and steam heating may be provided.

As described above, according to the present invention, cooking can be performed by using any of a high-frequency wave, steam, and electric heat; in addition, cooking means can be switched automatically from steam heating or from high-frequency-wave heating to electrothermal heating; thus if only a selection is previously made according to the intended cooking, cooking proceeds from one mode to the next without troublesome switching operation in the course; this, combined with the allowed choice of heating means, permits a wider range of cooking, and in addition achieves greatly enhanced usability.

4. Brief description of the drawings

Fig. 1 is a simplified longitudinal sectional view of a central part of a cooking apparatus according to an embodiment of the present invention; Fig. 2 is a basic circuit diagram thereof; Fig. 3 is a diagram illustrating how cooking orders are switched; Fig. 4 is a diagram illustrating cooking orders according to another embodiment; and Fig. 5 is a basic circuit diagram thereof.

In the drawings, (14) represents a heater for steam generation; (18) and (19) represent electrothermal heaters; (27) and (32) represent timer switches; (28) represents a high-frequency-wave oscillation circuit; (33) and (42) represent selection switches.

Among different drawings, the same reference signs indicate either identical or corresponding parts.

English Translation of Substantially the Whole of JP-A-54-127769, Published on October 3, 1979

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1. Title of the invention

COOKING APPARATUS

2. What is claimed is:

(1) A cooking apparatus, wherein

inside a heating chamber, there are provided a heater and a circulation fan that blows air to the heater,

outside the heating chamber, there is formed a steam supply passage,

the steam supply passage is made to communicate with the heating chamber such that convection occurs between inside the steam supply passage and inside the heating chamber, and

steam is supplied from a steam generation device into the steam supply passage somewhere midway therealong.

(2) The cooking apparatus according to claim 1,

wherein a position of an outflow hole of the steam supply passage is provided on an air inlet side of the circulation fan.

(3) The cooking apparatus according to claim 1,

wherein

in an upper part inside the heating chamber, a hot-air passage is formed with a partition formed of metal or a heat-resistant insulating material,

the heater and the circulation fan are provided in the hot-air passage, and

an air inlet of the hot-air passage is located on an outflow hole side of the steam supply passage.

(4) The cooking apparatus according to any one of claim 1 or 3,

wherein steam is intermittently supplied during operation of the circulation fan.

3. Detailed description of the invention

The present invention relates to a novel cooking apparatus that is realized by adding a steam supply function to a cooker in which hot air is circulated inside a heating chamber, with a view to expanding the range of cooking.

The invention will now be described by way of an illustrated embodiment. In Fig. 1, (1) represents a heating device body that is provided with an outer case (2), which forms an outer shell, and a heating box (4), which has a heating chamber (3) formed inside it. (5) represents a turntable that is provided in a lower part inside the heating chamber (3) and that is rotated at a speed of several revolutions per minute by a turntable drive motor (6) provided in a bottom part of the body (1) via a drive shaft (5A). (7) represents a magnetron that supplies a high frequency wave into the heating chamber (3) via a waveguide (8). (9) represents a high frequency wave supply opening. (10) represents a lamp that illuminates the interior of the heating chamber (3) through small holes (11) in a side surface thereof. (12) represents a hermetic water tank that is removably provided inside the body (1). (13) represents a vaporization chamber that has an electrothermal heater (14) provided in a bottom part thereof and that communicates with the water tank (12) through a pan (15) and a pipe (16) to be fed with water from the water tank (12) so as to keep a constant water level.

(17) represents an annular electrothermal heater that is provided in a bottom part inside the heating chamber (3) so as to enclose the drive shaft (5A). (18) represents a guide frame with a U-shaped longitudinal cross section that is provided in an upper central part inside the heating chamber (3), i.e. in such a position as to cover the supply opening (9) from below, that is formed of metal or a heat-resistant insulator such as porcelain, and that has an air exhaust opening (19) previously formed in a part thereof below the supply opening (9). (20) represents an air intake opening that is formed between an end part of the guide frame (18) opposite to the air exhaust opening (19) and the ceiling surface of the heating chamber (3). (21) represents a guide portion that is formed in a tip of the guide frame (18) at the air exhaust opening (19) side. (22) represents a heater that is previously disposed inside the guide frame (18) and that has a plurality of ventilation holes (23) for heat exchange formed in the entire portion thereof.

(24) represents a circulation fan that is rotated by a drive shaft (26) of a motor (25) which is so provided as to penetrate the waveguide (8) vertically, and that is located in an

entrance part, i.e. a part close to the air intake opening (20), of the guide frame (18). (27) represents a circulation fan case which is provided with an air outlet (28) at its one end and an air inlet (29) at the center of its lower surface.

(30) represents a heat-resistant cover that blocks the supply opening (9). (31) represents a through hole that is provided in a side surface of the heating chamber (3) below a part thereof corresponding to the turntable (5). (32) represents a through hole that is provided similarly in a side surface of the heating chamber (3) in the vicinity of and below the circulation fan (24). (33) represents a supply tube made of metal that is provided outside the heating chamber (3), with its interior space used as a steam supply passage (S), with its inflow hole (34) connected to the rim of the through hole (31), and with its outflow hole (35) connected to the rim of the through hole (32).

(36) represents a discharge tube that is provided so as to penetrate the bottom surface of the supply tube (33), with its lower end part facing inside the vaporization chamber (13). (37) and (38) represent exhaust holes that are provided in the ceiling surface of the heating chamber (3) and in the top surface of the outer case (2). (39) represents an exhaust duct through which those ventilation holes communicate with each other and in which is housed a temperature detection portion (40) of a cooking temperature adjuster (unillustrated) which controls the energization of the heaters (17) and (22) and the motor (25).

The operation with the above structure will now be described. First, to perform high-frequency-wave cooking alone, when a magnetron (7) is oscillated, a high frequency wave propagates through a waveguide (8) and radiates from the high frequency wave supply opening (9) into the heating chamber (3), so that food placed on the turntable (5) is heated and cooked efficiently.

Next, when the heater (17) is energized, the turntable (5) is heated from the bottom side thereof and its temperature becomes high; thus the food placed on the turntable (5) is heated from below. This, in combination with high-frequency-wave heating, makes it possible to heat food from outside and from inside simultaneously, and thus to achieve cooking with less uneven broiling and in a shorter time.

Next, with the energization to the heater (17) stopped or continued intermittently, when the heater (22) is energized, the circulation fan (24) is operated synchronously; thus air sucked in through the air inlet (29) of the fan case (27) becomes hot when passing through the ventilation holes (23) of the heater (22), and is then directed downward by the guide portion (21) of the guide frame (18) so as to be blown out downward through the air exhaust opening (19).

Thus, by the hot air thus blown out, the food on the turntable (5) is heated from the surface thereof and it is thus possible to burn the surface of the food; moreover, as indicated by arrows in the diagram, the hot air circulates inside the heating chamber (3), so that the atmospheric temperature inside the heating chamber (3) gradually rises, and this makes it possible to perform cooking with hot air. Radiating a high frequency wave during cooking using hot air enhances the food heating efficiency.

Note that, since the temperature detection portion (40) of the temperature adjuster (unillustrated) is housed in the exhaust duct (39), needless to say, the hot air temperature inside the heating chamber (3) is detected so that the energization to the motor (25) and the heaters (17) and (22) are controlled in such a way as to keep the atmosphere there at a predetermined cooking temperature previously set by a user.

Next, when the heater (14) is energized, a small quantity of water stored in the vaporization chamber (13) is rapidly heated to be vaporized, so that steam blows out from the tip of the discharge tube (36) towards an upper part of the steam supply passage (S). Here, if the atmospheric temperature of the heating chamber (3) has already been made high by the heater (17) or (22), hot steam is additionally supplied into that atmosphere to fill inside the heating chamber (3); thus, food can be cooked efficiently using heated steam. As steam is discharged through the steam supply passage (S), hot air inside the heating chamber (3) flows into the steam supply passage (S) from the inflow hole (34); thus, it is possible to efficiently introduce, without cooling, the steam discharged from the discharge tube (36).

In particular, when the circulation fan (24) is operated, since the air intake of the circulation fan (24) is directly above the outflow hole (35), steam can be efficiently heated and discharged in a concentrated manner through the air exhaust opening (19) of the guide frame (18); moreover, a larger quantity of air flows through the steam supply passage (S), and thus steam can be efficiently extracted.

Note that intermittent supply of steam during high-frequency-wave oscillation and during energization to the heaters (17) and (22) makes it possible to keep the food moderately dry during high-frequency-wave cooking; moreover, during electrothermal cooking, hot steam as is acts on food without decreasing the temperature of hot air; this is suitable in particular for cooking in which a large quantity of water is required.

Fig. 2 shows another embodiment of the present invention; compared with the embodiment described above, this embodiment differs slightly in the shape of the guide frame (18) and the position of the outflow hole (35), but achieves a similar effect. Note that the means for generating steam is not limited in any way to the structure of the above-described

embodiment.

As described above, according to the present invention, cooking can be performed with hot air and steam, and in addition, since the steam generation device is connected to the supply passage that, along with the interior of the heating chamber, forms a circulation passage, it is possible to efficiently supply the generated steam into the heating chamber; thus, it can be expected that various modes of cooking are performed in a shorter time.

4. Brief description of the drawings

Fig. 1 is a central longitudinal sectional view of a cooking apparatus according to an embodiment of the present invention; Fig. 2 is a central longitudinal sectional view according to another embodiment of the invention.

In the drawings, (1) represents a heating device body; (3) represents a heating chamber; (13) represents a vaporization chamber; (14), (17), and (22) represent heaters; (18) represents a guide frame; (24) represents a circulation fan; (34) represents an inflow hole; (35) represents an outflow hole; (33) represents a supply tube; and (S) represents a supply passage.

Among different drawings, the same reference signs indicate either identical or corresponding parts.